

ACUTE TOXICITY SUMMARY

ISOPROPYL ALCOHOL

(isopropanol, 2-propanol, dimethylcarbinol, propyl alcohol)

CAS Registry Number: 67-63-0

I. Acute Toxicity Summary (for a 1-hour exposure)

Inhalation reference exposure level **3,200 µg/m³**
Critical effect(s) irritation of the eyes, nose and throat.
Hazard Index target(s) Eyes; Respiratory System

II. Physical and Chemical Properties (HSDB, 1993 except as noted)

<i>Description</i>	colorless liquid
<i>Molecular formula</i>	C ₃ H ₈ O
<i>Molecular weight</i>	60.09
<i>Density</i>	0.78505 g/cm ³ @ 20°C
<i>Boiling point</i>	82.5°C @ 760 mm Hg
<i>Melting point</i>	-88.5°C
<i>Vapor pressure</i>	44.0 mm Hg @ 25°C
<i>Flashpoint</i>	11.7°C (closed cup)
<i>Explosive limits</i>	upper = 12.0% lower = 2.0%
<i>Solubility</i>	soluble in benzene, miscible with most organic solvents, slightly soluble in water, alcohol, and acetone
<i>Odor threshold</i>	19 ppm (geometric mean) (AIHA, 1989)
<i>Odor description</i>	sharp (AIHA, 1989)
<i>Metabolites</i>	acetone
<i>Conversion factor</i>	1 ppm = 2.45 mg/m ³ @ 25°C

III. Major Uses or Sources

Isopropyl alcohol has wide use in consumer products such as mild skin disinfectants and astringents. It is also used as a solvent for cellulose nitrate.

IV. Acute Toxicity to Humans

Symptoms of acute poisoning include dizziness, incoordination, headache, and confusion. Vomiting, hematemesis, diarrhea, and hypotension may occur following ingestion of large quantities of isopropyl alcohol. Late manifestations include aspiration pneumonia and kidney and liver dysfunction (Reprotext, 1993). The oral LOAEL for isopropyl alcohol is reported as 233 mg/kg (RTECS, 1993).

Irritation of the mucous membranes of the upper respiratory tract may occur following inhalation of isopropyl alcohol. Ten human subjects were exposed for 3-5 minutes to 400 or 800 ppm (1,000 or 2,000 mg/m³) isopropyl alcohol (Nelson *et al.*, 1943). Exposure to 400 ppm isopropyl alcohol produced mild irritation of the eyes, nose, and throat. When exposed to 800 ppm the majority of the subjects declared the atmosphere unsuitable for a prolonged exposure. The subjects indicated, however, that prolonged exposure to 200 ppm would not be objectionable.

Predisposing Conditions for Isopropyl Alcohol Toxicity

Medical: Persons with eye, skin, respiratory or neurological conditions and diabetics may be more sensitive to the toxic effects of isopropyl alcohol (Reprotext, 1999).

Chemical: Individuals exposed to acetone, carbon tetrachloride, or n-hexane may be at increased risk for adverse effects when exposed simultaneously to isopropyl alcohol (Reprotext, 1999).

V. Acute Toxicity to Laboratory Animals

A 4-hour rat LC_{Lo} of 16,000 ppm (39,000 mg/m³) isopropyl alcohol is reported (Carpenter *et al.*, 1949). Reduced ciliary activity and epithelial damage in the nasal mucosa of guinea pigs were observed following a 24-hour exposure to 400 ppm (1,000 mg/m³) isopropanol. Complete recovery from the exposure occurred within 2 weeks. Exposure at 5,500 ppm (13,000 mg/m³) resulted in similar damage requiring more than two weeks for complete recovery (Ohashi *et al.*, 1988). A 10-minute RD₅₀ of 17,693 ppm (43,000 mg/m³) for mice has been reported (Kane *et al.*, 1980).

VI. Reproductive or Developmental Toxicity

No human reproductive studies and only a limited number of animal studies on the effects of isopropyl alcohol were available. Pregnant rats exposed to 3,500, 7,000, and 10,000 ppm (8,600, 17,000, and 25,000 mg/m³) isopropanol for 7 hours per day on days 1-19 of gestation exhibited signs of maternal toxicity, indicated by retarded weight gain, following exposure to 7,000 ppm or greater. Signs of narcosis were observed in the dams exposed to 10,000 ppm. Fetal weight was reduced in all three exposed groups in a dose-dependent manner; increased skeletal and visceral malformations were observed following exposure to 7,000 ppm (Nelson *et al.*, 1988).

**VII. Derivation of Acute Reference Exposure Level and Other Severity Levels
(for a 1-hour exposure)**

Reference Exposure Level (protective against mild adverse effects) 1.3 ppm (3,200 µg/m³)

<i>Study</i>	Nelson <i>et al.</i> , 1943
<i>Study population</i>	ten human subjects
<i>Exposure method</i>	400 ppm for 3-5 minutes
<i>Critical effects</i>	mild irritation of the eyes, nose and throat
<i>LOAEL</i>	400 ppm
<i>NOAEL</i>	200 ppm (implied)
<i>Exposure duration</i>	4 minutes
<i>Extrapolated 1 hour concentration</i>	13 ppm ($200^1 \text{ ppm} * 0.067 \text{ h} = C^1 * 1 \text{ h}$) (see Table 12 for information on “n”)
<i>LOAEL uncertainty factor</i>	1
<i>Interspecies uncertainty factor</i>	1
<i>Intraspecies uncertainty factor</i>	10
<i>Cumulative uncertainty factor</i>	10
<i>Reference Exposure Level</i>	1.3 ppm (3.2 mg/m³; 3,200 µg/m³)

Ten human subjects, exposed for 3-5 minutes to 400 ppm (1,000 mg/m³) isopropyl alcohol, reported mild irritation of the eyes, nose and throat. The study indicates a 4 minute LOAEL of 400 ppm. The subjects indicated that exposure to 200 ppm would be tolerable, which implies a NOAEL of 200 ppm. This 4 minute NOAEL was time adjusted to 1 hour. An uncertainty factor of 10 was applied to the 200 ppm NOAEL to account for the susceptibility of sensitive individuals.

Level Protective Against Severe Adverse Effects

Rats were exposed for 6 hours to 0, 500, 1,500, 5,000, or 10,000 ppm isopropyl alcohol (Gill *et al.*, 1995). Signs of narcosis and concentration-related decreases in motor activity were observed in rats exposed to 5,000 or 10,000 ppm. Slight but statistically significant decreases in motor activity were observed in male, but not female, rats exposed to 1,500 ppm isopropyl alcohol. No adverse effects were observed in rats exposed to 500 ppm isopropyl alcohol. Narcosis during isopropanol exposure at 1,500 and 5,000 ppm was also noted in a chronic inhalation study by Burleigh-Flayer *et al.* (1994). A 6-hour NOAEL of 500 ppm is defined from this study. An uncertainty factor of 10 was applied to account for interspecies differences. An additional uncertainty factor of 10 was applied to account for sensitive individuals. An equivalent 1-hour exposure concentration was estimated from the reported 6-hour NOAEL using the equation $C^n * T = K$, where $n = 2$. The resulting level protective against severe adverse effects is 12 ppm (29 mg/m³).

A TLV-TWA of 400 ppm is reported by ACGIH (1991) based on findings by Nelson *et al.* (1943); the NRC-EEGL of 400 ppm is based on the TLV (NRC, 1984). However, the reported 3-5-minute exposure to 400 ppm was not extrapolated to a 1-hour equivalent by NRC. Using the

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equation $C^n \cdot T = K$, where $n = 1$, the equivalent 1-hour exposure is 20 ppm. This is consistent with our use of the animal studies. In addition, the recent data described above (Gill *et al.*, 1995) were not available to ACGIH or NRC when determining these values.

Level Protective Against Life-threatening Effects

No recommendation can be made due to the limitations of the database.

NIOSH (1995) lists an IDLH of 2,000 ppm (4,900 mg/m³). The IDLH is based strictly on safety considerations and is 10% of the lower explosive limit of 2%.

VIII. References

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